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# HeyMoe: Leveraging virtual robot and game mechanics in mobile prototype application design for Chinese language learning

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# **HeyMoe**

Leveraging virtual robot and game mechanics  
in mobile prototype application design  
for Chinese language learning

# **Boxiao Gong**

A Thesis Submitted in Partial Fulfillment of the Requirements  
for the Degree of Master of Fine Arts in Visual Communication Design

Rochester Institute of Technology  
School of Design  
College of Imaging Arts and Sciences  
Visual Communication Design  
Rochester, NY  
July 13, 2018

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# Abstract

With the growth of internet technology, individuals currently have a better experience in using interactive systems like desktop computer software or mobile device applications than ever before. Moreover, using mobile phones in learning activities is becoming increasingly popular. However, the learning applications today do not fully meet the learner's needs, especially for young adults who have some interest but lack fundamental knowledge in their study subjects. Combining mobile phone technology and game elements could make it possible to solve this problem. In this way, the limitations of location and the sometimes boring nature of the learning activities could be efficiently reduced. This study presents an idea of applying virtual robot and game elements to language learning activities and creating a mobile device application prototype to enhance the learner's Chinese study experience.

## Keywords

language learning, emotional design, immersive learning, location detection, college education, Chinese, user experience, user interface design, mobile application

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# Introduction

## Background

Today, the educational process such as in classrooms or museums in their traditional form fail to engage and motivate students (Eleftheria et al. 2013). Many instructors in education using conventional teaching methods (textbooks, lectures) currently are facing this kind of problem with students. The traditional learning methods which rely on reading textbooks or attending lectures seem to make learning Chinese difficult for English-speaking students and miss opportunities to leverage technology and online resources that are available.

## Problem Statement

Due to the increase in digital distractions that students have, many instructors in the area of second language education are having problems with student motivation and engagement in learning. The reason for this is that the process of traditional learning methods seem uninviting or difficult to students and miss opportunities to leverage technology and online resources in new ways. Gamification design, which is using gaming principles (i.e., challenges, feedback, interactivity, and so on) in non-game contexts, would help to solve this issue by putting students in playful scenarios that encourage them to do and understand learning materials by themselves. This project aims to develop a solution to increase the student's Chinese language learning experience by designing a mobile device application prototype that leverages the flexibility of mobile technology through location, communication and media controls while incorporating the rewards and challenges from game theories.

The idea of gamification has been applied to many fields such as business management, marketing, corporate management, wellness initiatives, time management, education, and so on. For example, there is a to-do app called HabitRPG. It tracks the user's agenda, and rewards the users if they complete a project with points and gold. There are many projects now focusing on using the concept of gamification in educational apps. For Chinese learning, an existing mobile application is HelloChinese. It is an application embracing education and gamified education. It consists of a series of engaging digital language game elements of achievements, challenge and immersion that make learning Chinese enjoyable and accessible.

The four major objectives of the project are:

1. Increase learners engagement by creating a playful learning experience
2. Enhance learners motivation by tracking their study progress
3. Help learners study smarter by detecting users location and make recommendations using relevant information
4. Make users feels open and content by creating an AI robot in the study app

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# Context

The implementation of the application aimed to achieve four objectives: increase learners engagement, enhance learners motivation, help learners study smarter and make users feel open and content during the learning process. Based on the research, four approaches were applied in the project for achieving these goals.

## Mobile technologies for education

As a heated topic in recent years, e-Learning involves all the learning activities that take place in internet settings. Different from e-Learning, the term Mobile learning is applied to the educational activities just with mobile devices (Botha et al. 2010). Based on the advantages it has, Mobile learning is becoming an essential tool in the educational area (Nagalingam et al. 2017). As this trend goes on, it becomes increasingly popular in Chinese learning community. Therefore, the author aims to create an enjoyable Chinese language educational environment using Mobile learning technology for this project.

The primary benefit of using mobile devices could be it can help users to overcome the limitations of time and space. But it still has usability problems, such as each student might not be able to follow the same model with similar education material (Nimkoompai et al. 2017). For foreign language learners, the standardized teaching methods such as Reading Method (learn through reading to gain new words and grammar points), Grammar-translation Method (learn by translate article passages) are not meeting learners' full needs. Mobile technologies allow for these methods to be combined in more flexible pathways that incorporate multiple media types, audio, animation and location-based information. Giving users access to learning materials that reflect their environment, activities and current interests. If they do not understand something, they will not have a chance to figure it out by themselves, but the ability of mobile solutions to interconnect information assists users retention and increases engagement.

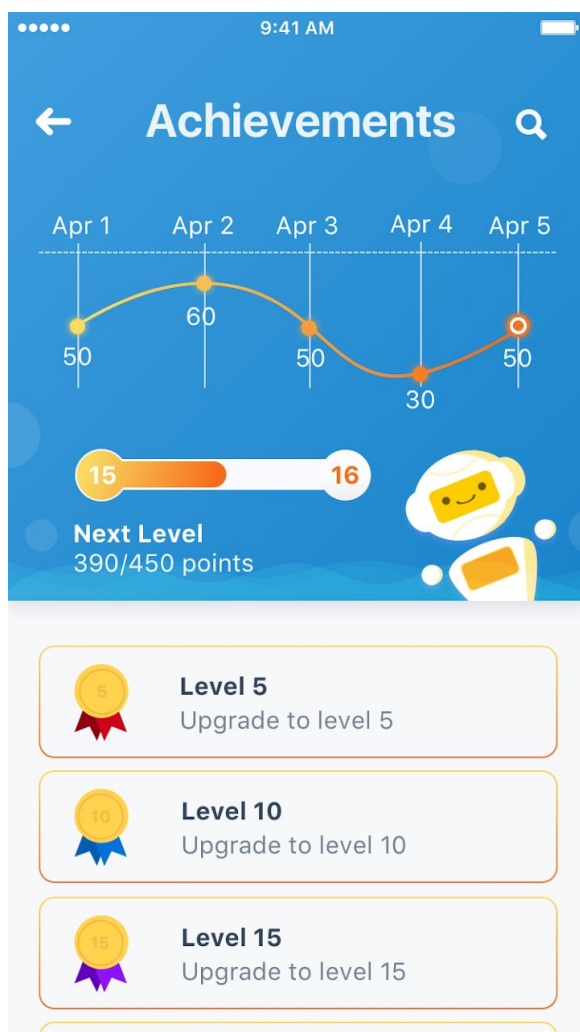
## Gamification and user experience

Recently, there is an increasing number of people using gamification in various fields. Gamification is applicable in domains as diverse as marketing, health and wellness, crowdsourcing, online communities, social networks and of course in education (Seaborn et al. 2015). The game is often attractive to people for the reasons of what they find in games; players could gain more joyful experiences that they might not find in traditional learning environments. The game elements could be the critical part that the game.

Gamification is not game. Sebastian, et al. define Gamification as "the use of game design elements in non-game contexts" (Deterding et al. 2011), i.e., game mechanics and concepts are applied on non-gaming environments to reach specific goals. Examples of goals include

improvement of user engagement, increased participation, enhanced motivation or just having more fun. The “non-game contexts” part of the gamification definition refers to transferring game elements from gaming systems to non-entertaining services and applications to improve user experience, engagement, and motivation (Deterding et al. 2011).

Game elements in this application benefit the learner through three main game elements. The challenge component is applicable in the word quizzes found in the location-based, learning section. The immersion component is used in the conversation study that is found in the course study section. These elements are for enhancing the engagement of the users. Users can go to the home page to monitor their success with the achievement component. Letting them continually track their progress will help to motivate them to continue their study. Figures 1 and 2 are two UI examples of the implementation of this context section in this project.



**Figure 1.**

**Figure 1.** The achievement component lets the user see what they have achieved.



**Figure 2.**

**Figure 2.** The challenge component uses word quizzes to test their word recognition.

## Robot tutor in learning activities

The goal of the robot design is to enhance the user's learning experience by creating an easy tool to allow them to access information, form a digital bond and study with a tutor in the application. "Bots are the new apps," - Microsoft CEO Satya Nadella. Moreover, users often go to bots for exploring prompt answers or recommendations. (Lollypop Design Studio. 2018)

The robot benefits the application by creating a personalized study environment for the learners. It displays facial expressions in the learning process. The robot makes the learning process better and easier by providing instant feedback during the learning process, as well as access to quick answers and support through visual, verbal interactions. Four screen examples (Figures 3, 4, 5, 6) below show the implementation of this context.



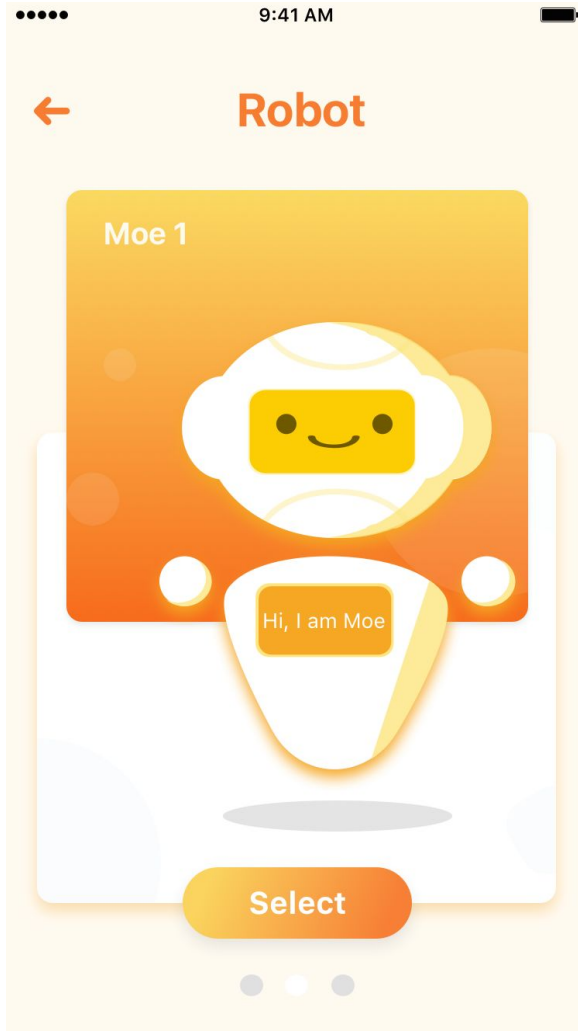
**Figure 3.**



**Figure 4.**

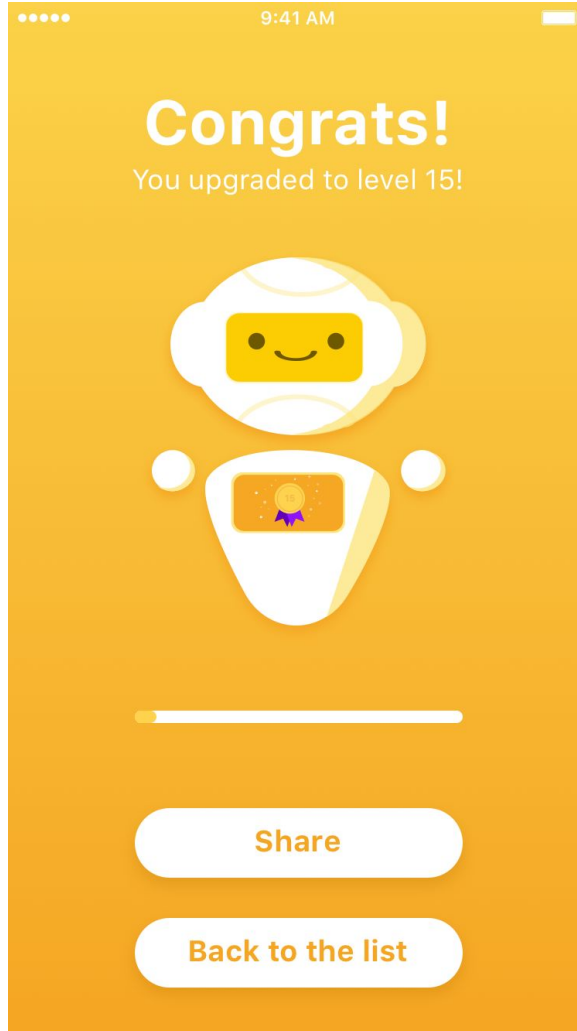
**Figure 3.** The robot tutor appears in the study pages to work with the learners.

**Figure 4.** Moe will show a smiley face (facial expressions) when the user has answered correctly.



**Figure 5.**

**Figure 5.** Users can select different appearances for their robot.



**Figure 6.**

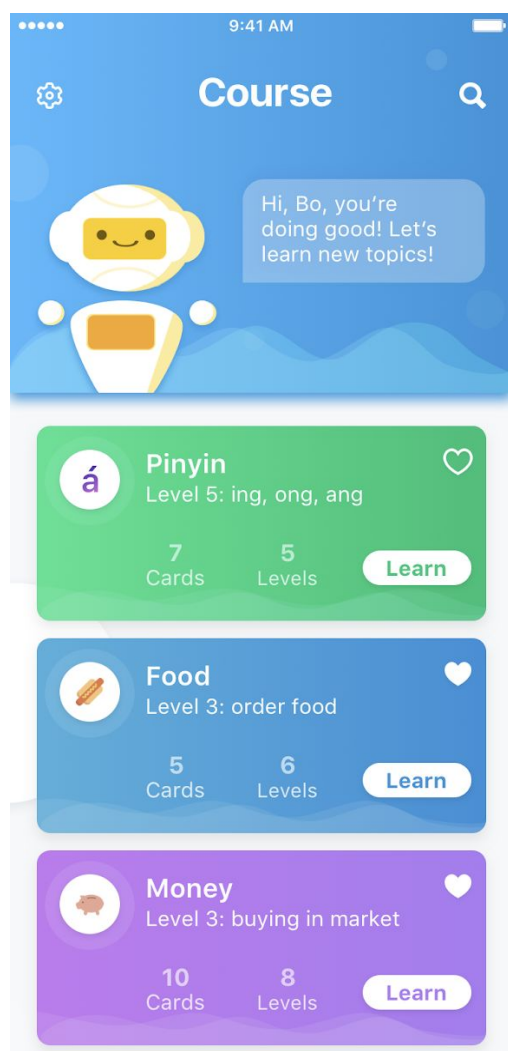
**Figure 6.** Moe will celebrate with the user after the study process is completed.

## AI and GPS technology in language education

Studying a new language can be remarkably difficult. It needs a lot of effort, time and commitment. (Ergürel. 2017) This application aims to make the language learning process more accessible for the learners by applying AI and GPS technology in the application.

Users could learn location-based words and sentences quickly through the cards and word challenges. The application uses GPS and AI technology to detect and understand the user's location automatically and creates Chinese word cards. Moreover, the word challenges use multiple-choice questions for taking away the burden of typing from the users. (Lollypop Design Studio. 2018) Furthermore, fluency in a language is not only how many words you know, but how well you communicate with the words. (Ergürel. 2017) Based on location, the app uses AI

database to generates conversation and word study materials. The course aims to support users in developing their Chinese speaking abilities. Figure 7 shows the Course page (AI technology), and Figure 8 shows the Location page (GPS technology).



**Figure 7.**



**Figure 8.**

**Figure 7.** The course page generates language topics for the learners to study.

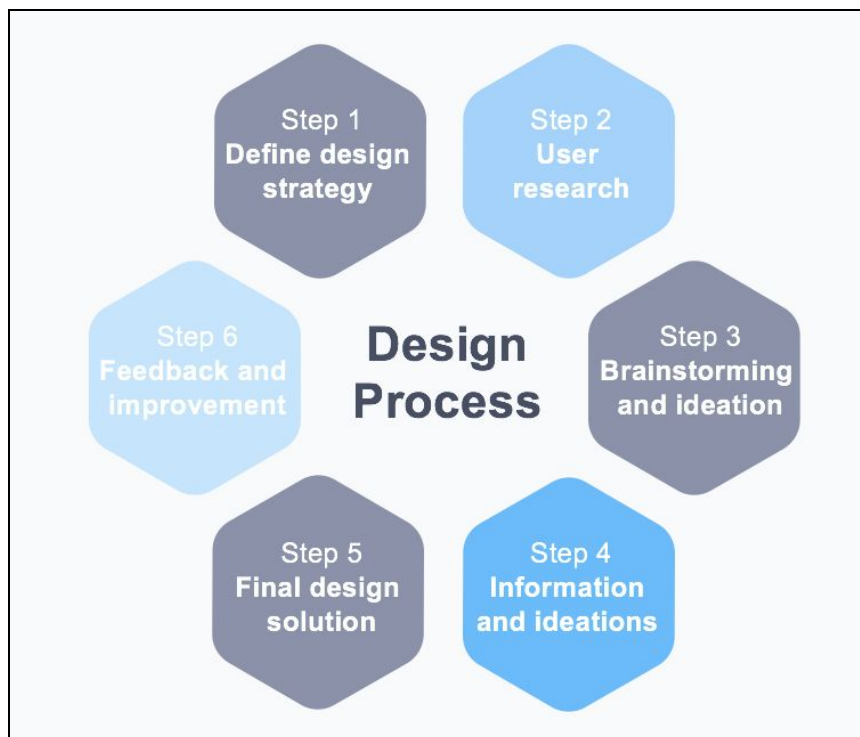
**Figure 8.** The location page, using GPS technology, identifies the learner's location and creates appropriate word cards.

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# Design Process and Solution

## Define Design Strategy and User Research

The primary concept of this project is to practice interaction design for language learning activities. Technologies such as AI (uses database to generates learning content, and AI-robot to develop feedback in the study process) and GPS (detect location to recommend study materials to learners) were applied to the application design. Moreover, tools of gaming are also used in the application. The project followed a standard design process. The process is shown in Figure 9 below.



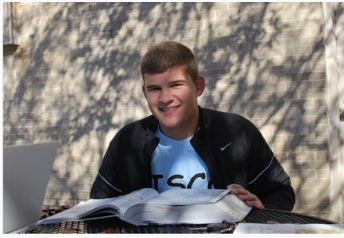
**Figure 9.** The infographic of design process

The target audience of the application is American learners with an age range between eighteen to sixty. Users could be normal people who just want to get a little taste of what Chinese language is like. A second generation of immigrants from China as well as International travelers to China might be additional audiences.

The most valuable personas are based on observing real individuals. Personas play starring roles in scenarios, short stories built around achieving a specific goal. (Lupton. 2017) Based on the target user, the author created two personas (Figure 10 and 11):



## Persona 1: Tony Davis



"I like Chinese language very much."

**Age:** 25  
**Work:** student  
**States:** single  
**Location:** Rochester, NY  
**Character:** easygoing

### Goals:

- To learn Chinese language effectively in the US
- Get greater understandings in Chinese language
- Work in the area of China-America Trade after graduate

### Frustrations:

- Current Chinese study apps are a little bit boring
- Can not find a way to practice Chinese dialogs efficiently
- Feels do not have a Chinese learning environment and feels lonely

### Bio:

Tony is a senior business student at the RIT, and he comes from western Arizona. In his second year of the college study, he had a chance to go to a university in China for an exchange study for a semester. He went to China and really attracted by the culture in China. He loves Chinese food and kung-fu. After he came back to RIT, he want to continue studying Chinese in the U.S. After he graduates from the college, he wants to pursue a career in the China-America trade area.

**Figure 10.** Persona A - Tony Davis  
(Image Source: Pixabay, pixabay.com, 2018)

## Persona 2: Emma Wang



"I love Chinese movies and food."

**Age:** 18  
**Work:** student  
**States:** single  
**Location:** New York, NY  
**Character:** outgoing

### Goals:

- To learn Chinese language by herself for free
- Study daily life conversation for interactions with relatives in China
- Being an actress and collaborate with Chinese movie stars in movies

### Frustrations:

- Chinese textbooks are too boring
- Difficult to find Chinese study resources in the local schools
- Forgetting the Chinese skills that she learned in childhood

### Bio:

Emma comes from a Chinese immigrant family. She is a first-year college student in New York, and she wants to learn movie major in the school. In her childhood, her parents taught her Chinese. But after she got into high school, she had less chance to practice Chinese so she started to forget what she learned what she learned before. Her parents and herself both do not want her to forget all the Chinese she gained. So she wants to find some way to study Chinese by herself. She likes Ang Lee very much. She also likes many movie stars in China such as Jackie Chan, Jet Li, and so on.

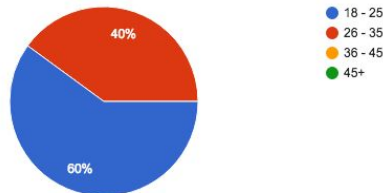
**Figure 11.** Persona B - Emma Wang  
(Image Source: Pixabay, pixabay.com, 2018)

To sum up, users believe that current Chinese study methods are tedious and not very efficient. They want to get an interesting and effective tool to help them study Chinese. In addition to creating personas, surveys were developed to gain a better understanding of the target

markets, their level of understanding in second language applications and use of mobile gaming. Below are the questions and the answers:

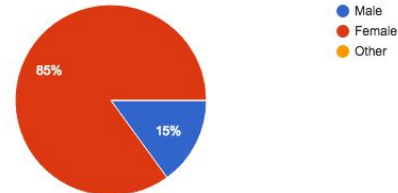
How old are you?

20 responses



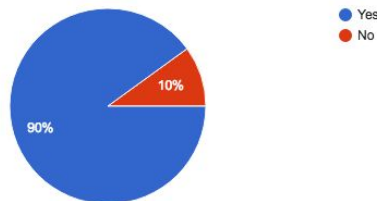
What is your gender?

20 responses



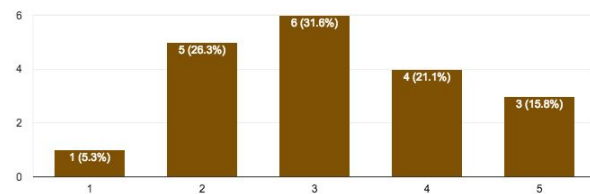
Do you play mobile games?

20 responses



How helpful do you think the game-based second-language learning apps in your study process?

19 responses

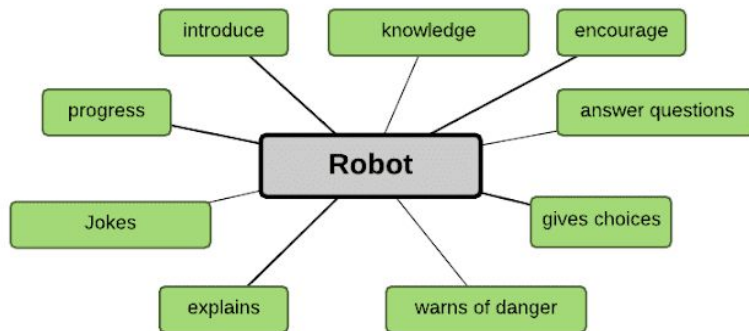


The survey result indicates that the targeted age group of this project heavily uses mobile devices and plays mobile game (90%) in their everyday lives. Moreover, many of them like to play games to fill their times (65%). The last question in the survey is an open-ended question. It is about "What problems do you have with game-based second-language learning apps?". The answers to that question include (1) cannot practice verbal, (2) not funny enough, (3) do not have enough details and cultural components. The survey positively inspired the study.

## Brainstorming and Ideation

To fully engage the user's and leverage the benefit of mobile e-learning, a three tiered approach was created. The three approaches are: Location, Gaming and AI-bot, which reflects the components of Gamification, Robot tutor as well as GPS technology in education that was written in the contexts section above.

Today, emotion and pleasure are essential components of user experience design. (Lupton. 2017) To enhance the UX level of the application, the author designed an AI-robot in the learning process. This robot can learn with users and travel with them. It can also have conversations with the users. Figure 12 shows the brainstorming (mind map) process.

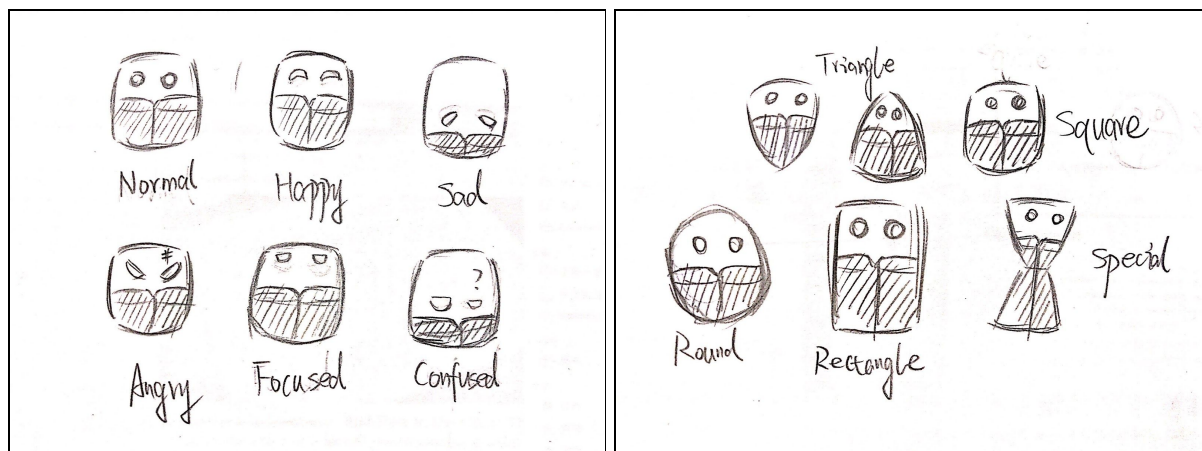


**Figure 12.** A mind map for the idea of the robot

The name of the robot is “Moe”. This name comes from a Chinese character that refers to feelings of affection towards characters that appear in anime or video games. It has a cute appearance and pleasant emotions. The bot has three major goals:

- Study together and travel with the user so they will not feel alone
- Learn words and do quizzes to help the user master Chinese words
- Provide conversations to help the user become a better communicator in Chinese

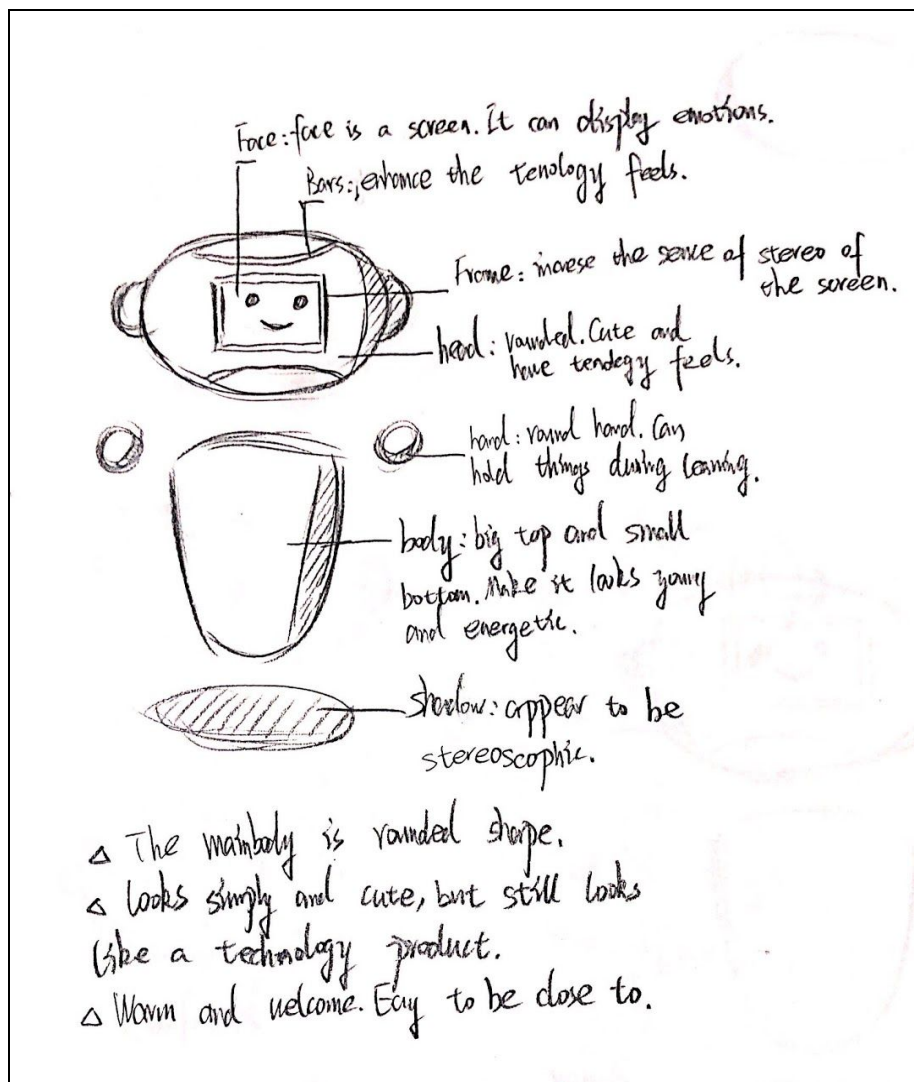
The first robot concept was developed as below (Figures 13, 14). It has a simple and adorable look, with emotions added to the face to be responsive. But the problem is that they are too simple, so it would be hard to express emotions transparently to the users. Moreover, the appearance of it would make people feel a lack of technology.



**Figure 13,14.** Sketch of first robot concept

Based on the initial design concept, the design of the robot was revised to a better fit into the goal of the application (Figure 15). The primary purpose of the robot's design is to be a cute and welcoming companion to the users. It's body is rounded and light to reflect its sense of science and technology. The principal color of Moe is white and yellow to represent the feelings of clean, gentle and bright. The shadow makes it more stereoscopic.

On the head of Moe, there is a small screen (yellow) with a thin frame (grey). That is the face of Moe, and it is the most critical part of him. It shows emotions during the users learning process. When learners answered the questions right, it will be happy, and if the questions were answered wrong, it would be confused. After users completed a lesson, Moe will be excited and celebrate the success with the users. If users hold there for a too long time, it will get tired and sleepy. It is this personification of the robot that will assist the user in becoming more attached to the robot during the experience.

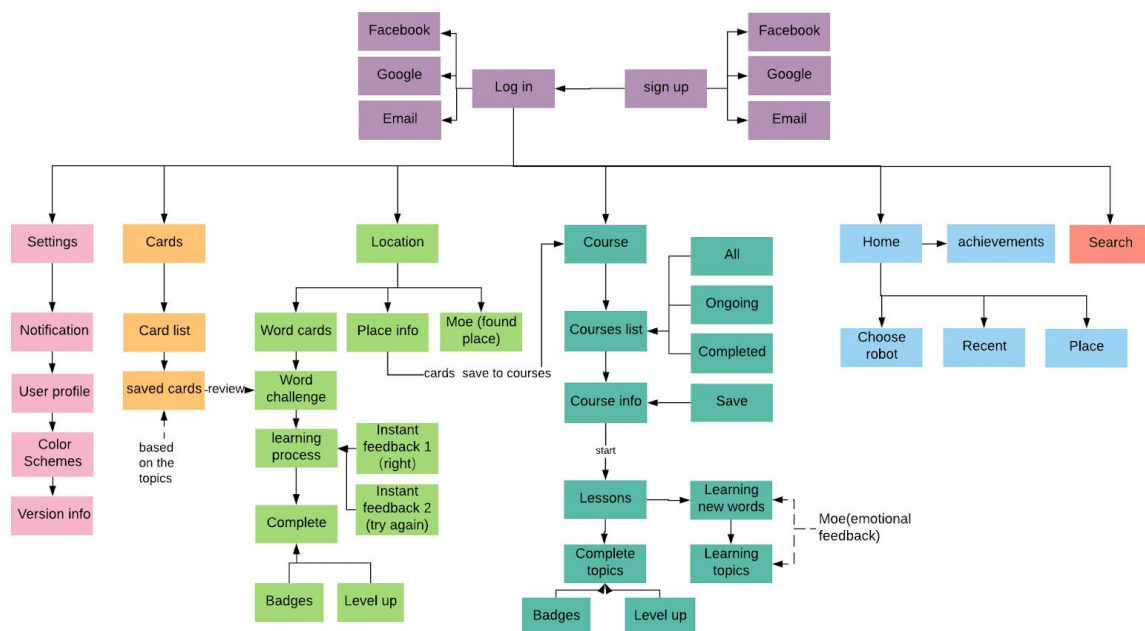


**Figure 15.** The design ideas of each part of the robot

## Develop of Information and Design Ideations

The flowchart demonstrates the overall structure of the application. The application has four significant functions; location, courses, cards and robot sections that reflect the three essential components of gaming, location, and robot in the context section. The location section detects learners location and recommends study contents based on the users location and activity such as a store or restaurant. The course section generates everyday life language points which Includes words and conversations and can be started and completed on demand. The Cards section contains cards that created based on the places learners visited and courses completed. This section creates a unique set of challenges that continue to change based on the users interactions and locations. The learners can check their progress (game elements) in the Home page each day along with receiving notifications and prompts to engage with the app. The robot work with learners in all the study areas to keep the user moving forward, answer questions, give feedback and show support.

The flowchart (Figure 16) was developed for describe the structure and activities of the application. To make it easy to understand, the author used color coding method to represent different sections. Green represents location; dark green represents course and blue represents homepage (dashboard). There are also two additional sections represents settings (pink) and search(red).

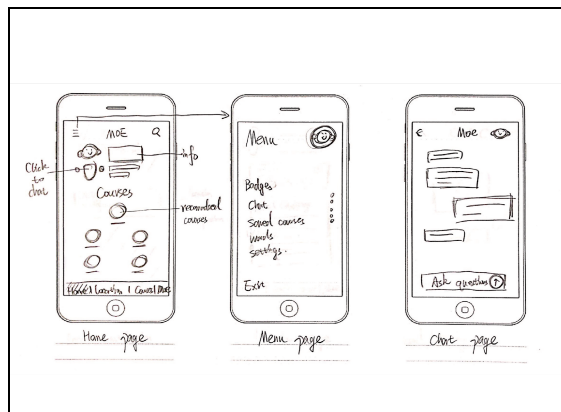


**Figure 16.** The flowchart of the project

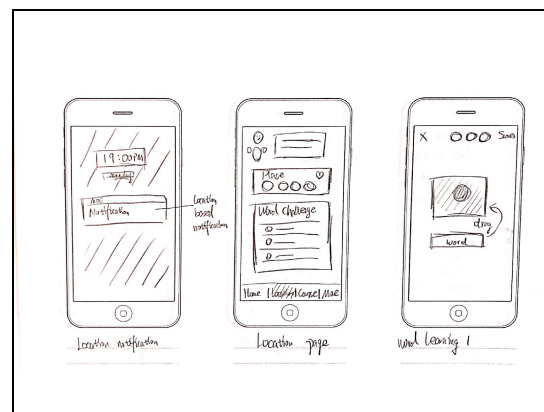
Furthermore, during the design process, sketches are drawn on papers for supporting the design ideas. They were made before designing the interfaces. This work is for building and confirming all the UI design ideas. Moreover, this also aims to reduce misunderstandings and to examine the contents, page layout, and functionalities. They helped the author to develop



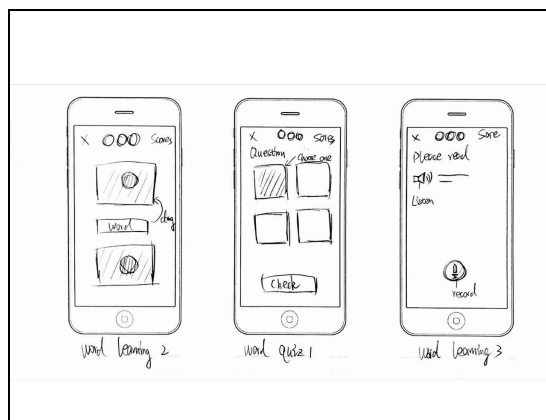
conceptual thoughts into specific designs. Through the sketches, the author explored and examined the visual style, icons, screen layouts. Figure 17-22 shows the paper sketches.



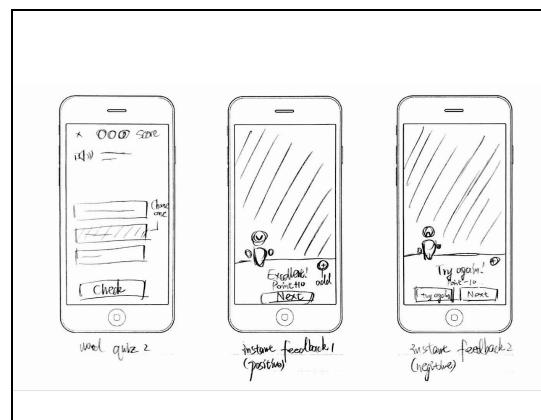
**Figure 17.** The paper sketch for home, menu and chat pages



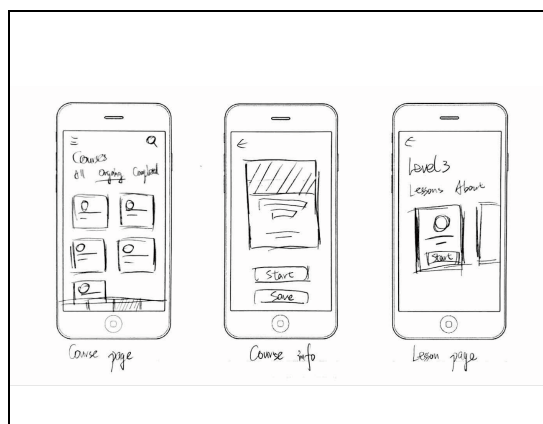
**Figure 18.** The paper sketch for location and word learning pages



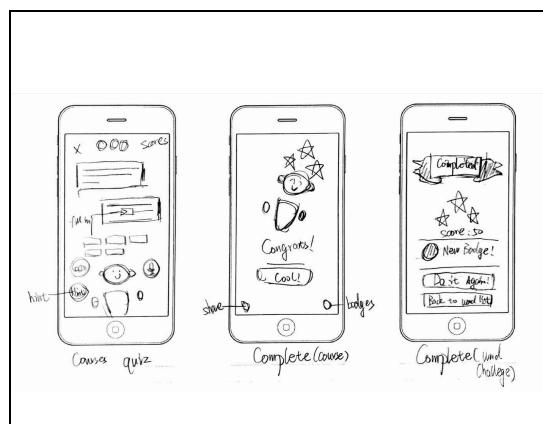
**Figure 19.** The paper sketch for Word learning pages



**Figure 20.** The paper sketch for word quiz, instant feedback pages



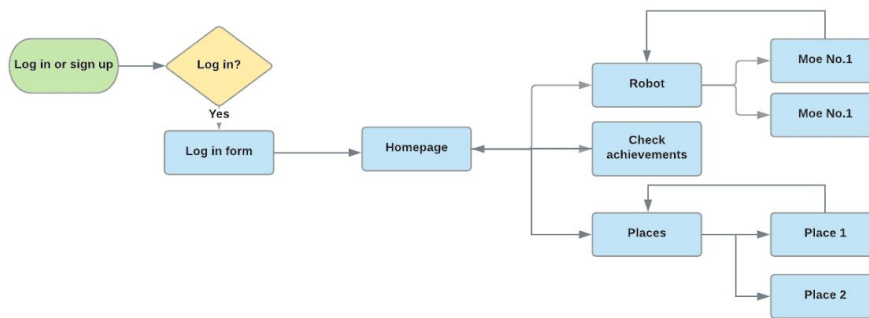
**Figure 21.** The paper sketch for course, course info, and learn pages



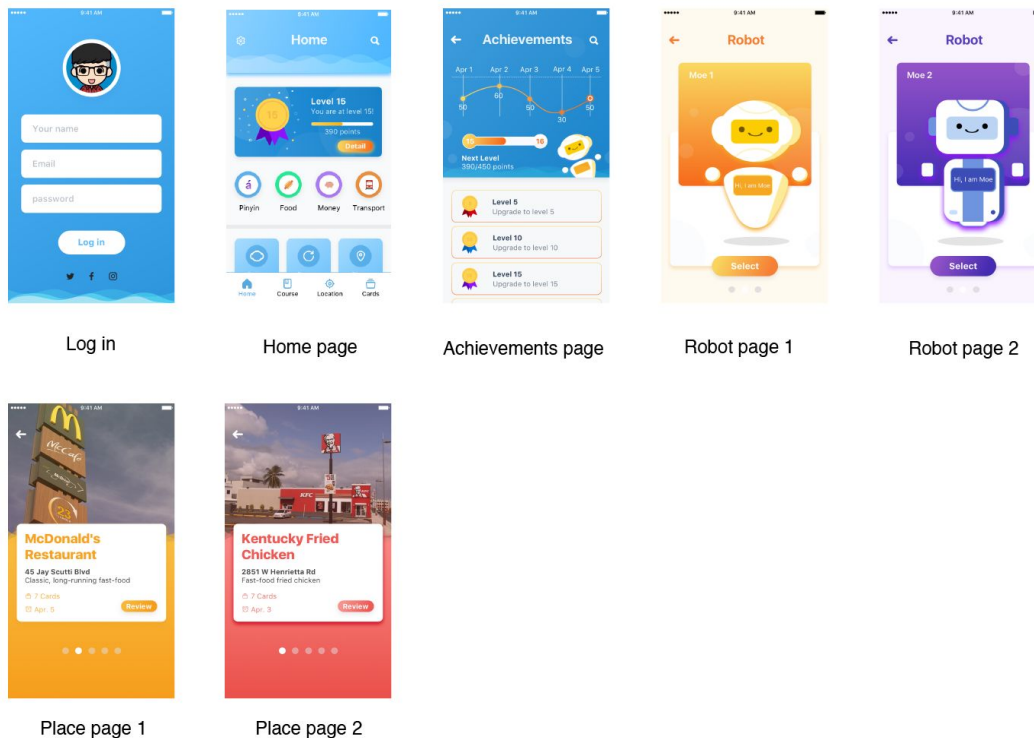
**Figure 22.** The paper sketch for course quiz, complete pages

## Use Case Scenarios

Three use case scenarios were created to showcase the significant functions of the design solution of the application. After each flow, UI sequences were embedded for supporting the use cases. The first case is homepage functions, and it links to the context of gamification. The first use case is Homepage functions (Figure 23, 24). This case presents the implementation of Gamification context above. Users can log in to the app, and go to the Homepage. From the Homepage, users can then check their progress and review how much points and badges they received. They can also change the robot they would like to study with and revisit the words they have learned from the Places page.



**Figure 23.** Use case 1 - Homepage functions (check progress and change robots and places)



**Figure 24.** User interfaces sequences for use case 1

The second use case (Figure 25, 26) is location-based word learning. It reflects the context of GPS technology in language learning. When learners arrive at a place, for example, KFC (Kentucky Fried Chicken), the application will detect the location and recommend relevant materials for study. From the word list of the location page, users can go to a Word card page. The card has two sides: the front side shows the necessary information of the word while the back of the card indicates additional study materials. Learners can then take a word quiz. During the word study process, Moe will give users instant feedback, letting them know if they have answered correctly (increase in points) or incorrectly (decrease in points). The information and progress will be stored in the cards section to help the user repeat lessons after visiting a particular location.

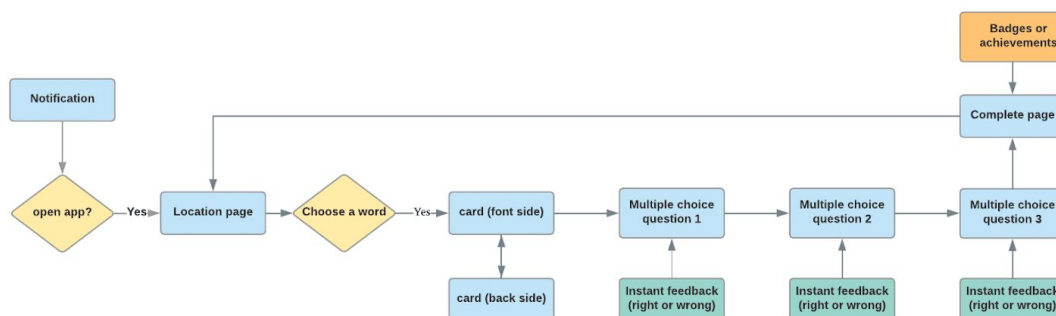


Figure 25. Use case 2 - Location-based word learning

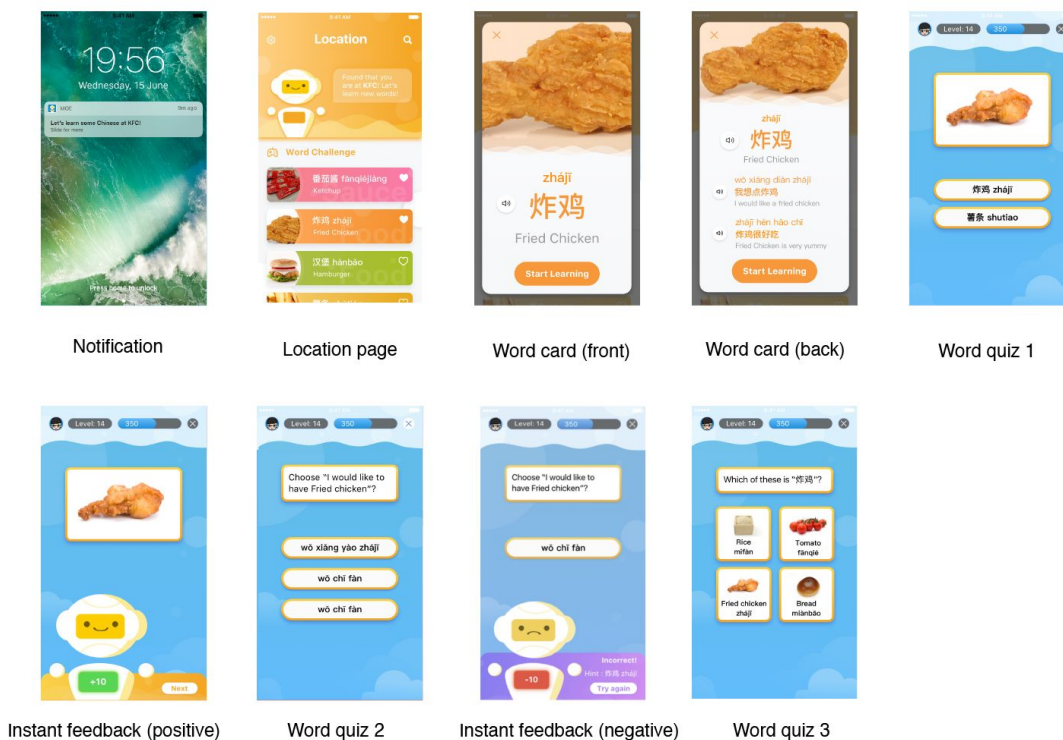
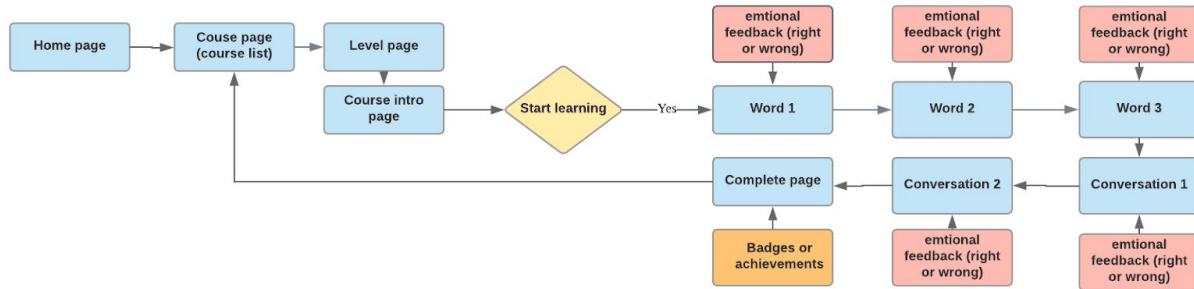


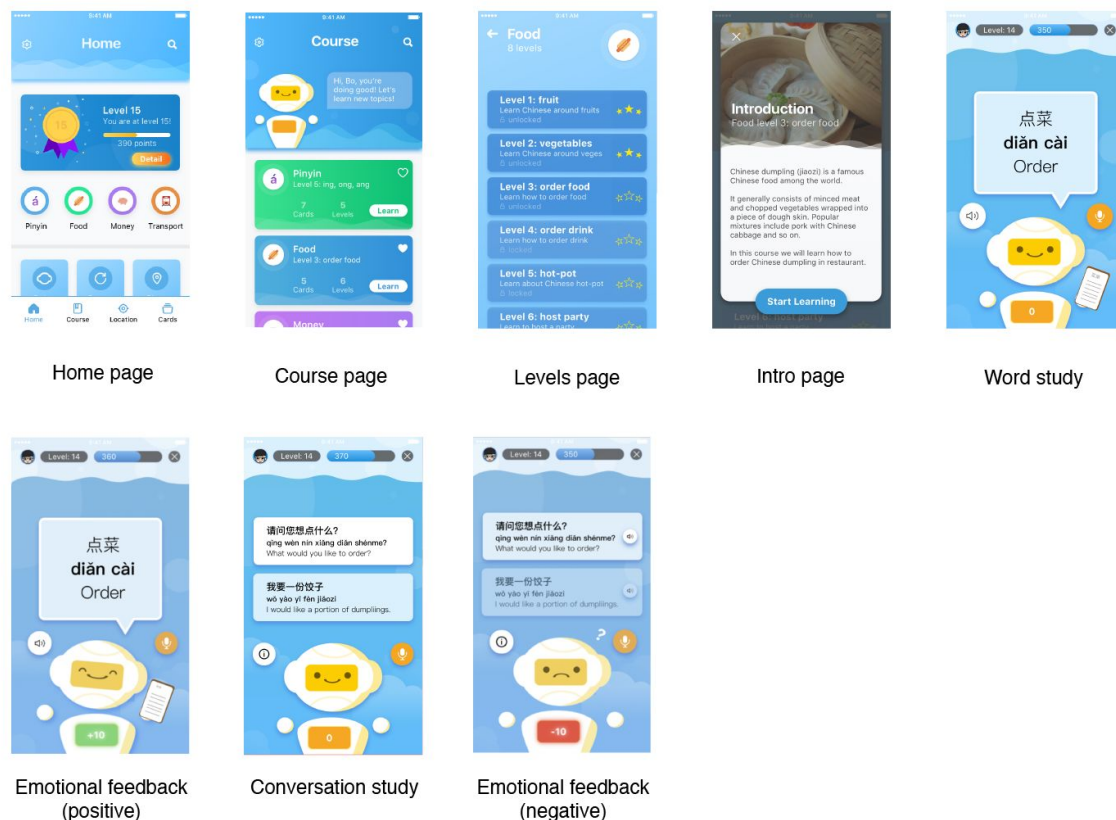
Figure 26. User interfaces sequences for use case 2



The third use case (Figure 27, 28) is for the study of everyday words and conversation. This case develops the context of AI technology in language learning. Learners can go to the Course page from the Homepage. The course section auto generates topics that include words in daily use and dialogs based on the places users have visited. For instance, if the application detected learners went to a restaurant or food market, it would generate a food topic. It will also create levels from beginner to advanced based on the user's situation. Learners can go from the appropriate level to the course introduction page to begin learning. During the study process, Moe will work with learners and provide emotional feedback, both positive and negative.



**Figure 27.** Use case 3 - Study of everyday words and conversation

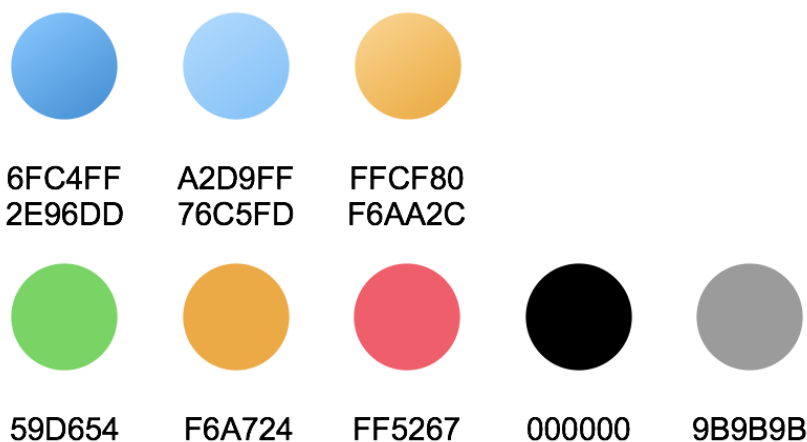


**Figure 28.** User interfaces sequences for use case 3

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## Final Design Solution

To accomplish a holistic design solution, a visual system was developed. Color Studies has been conducted for the design of the application. Color is vital for it produces a sensory impression that reflects mood and emotion. (Lupton. 2017) Although color has different symbolic meanings in different cultures, scientific research suggests that in the absence of other cues, some responses are nearly universal, or widely shared among people. (Lupton. 2017) The primary colors are blue and yellow. The utility of the color of Blue is to produce calm and convey tranquillity, serenity, and peace for the learning application. Yellow is the color of optimism. The use of it is mainly on the robot, and it conveys youthful and fresh energy. The Secondary level of colors is neutral colors - black and grey. Those colors could increase the readability of the text and coordinate the visuals for the users. Figure 29 shows the color patterns of the application.



**Figure 29.** The color patterns of Moe

Typefaces selection is a vital portion of this study for it is a language learning application. The author aims to find fonts that can display text in a bright, mild, and modern way in the screens. Therefore, Sans-serif became the ideal choice for the design. San Francisco typeface was chosen based on that thought.

Moreover, another font for Chinese text display is demanded in the application. The font needs to match the English texts and also be Sans-serif typeface. After careful research and consideration, pingfang (苹方) was chosen for the project. It used in many of the interaction design works in China. It shows a similar shape as SF UI text and fits well in the interfaces. Eventually, two typefaces were picked to meets the purpose of application design.



Figures 30 -56 showcase the application of the design across all application screens.



Figure 29, 30. Location page and Cards page

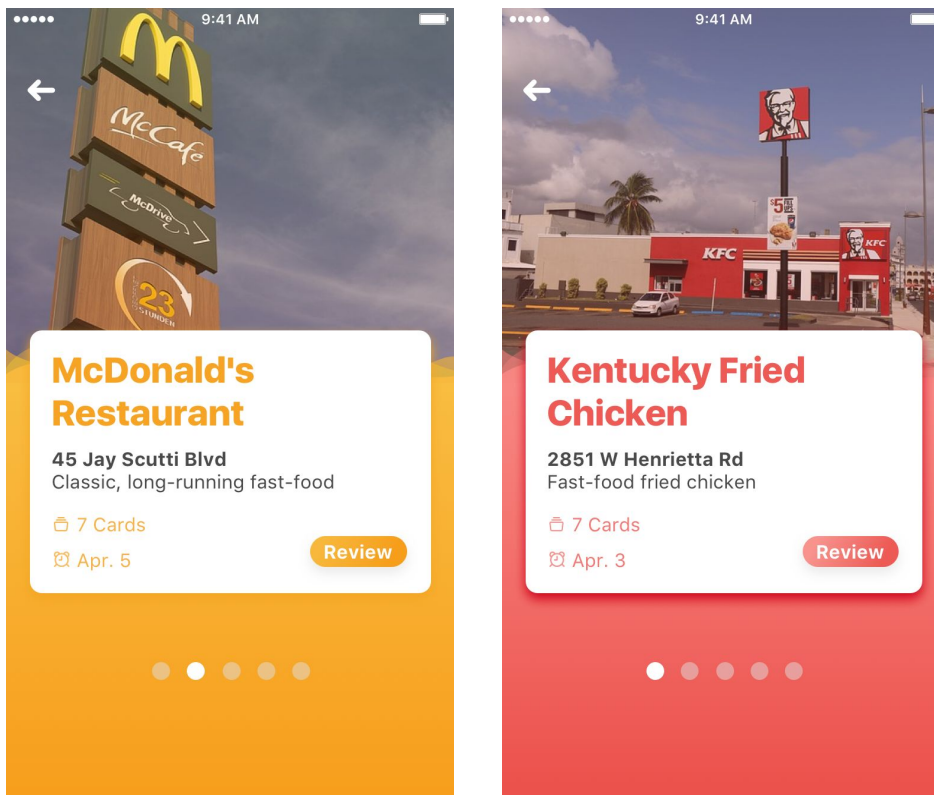


Figure 30,31. Places page (McDonald's and KFC)

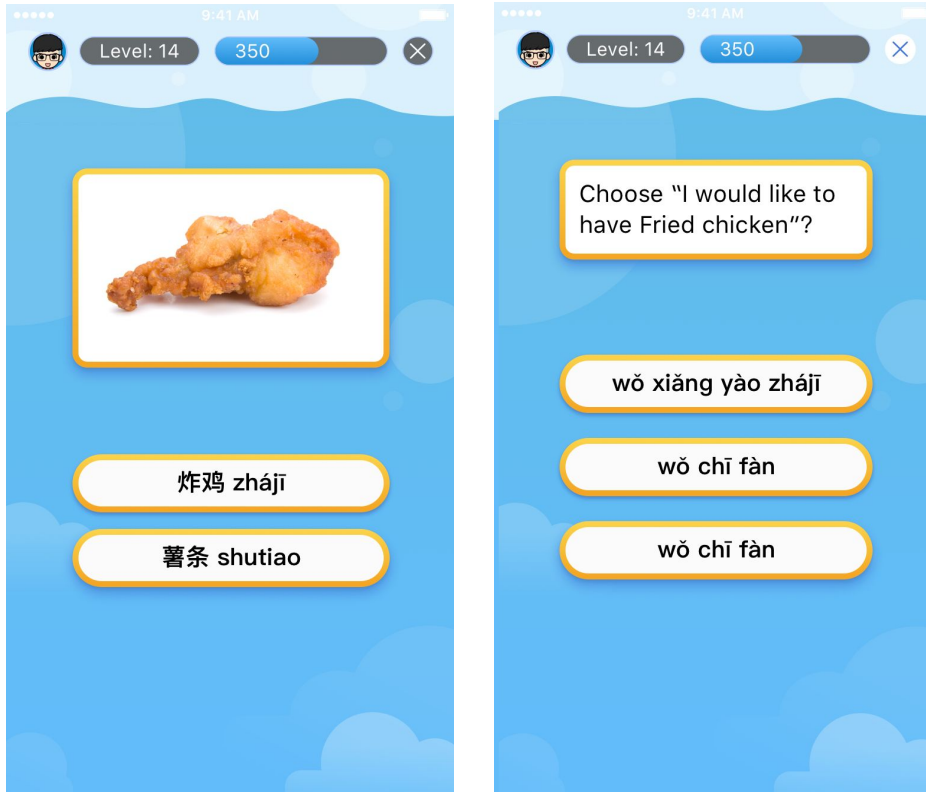


Figure 32,33. Word quizzes page (Multiple Choice question)

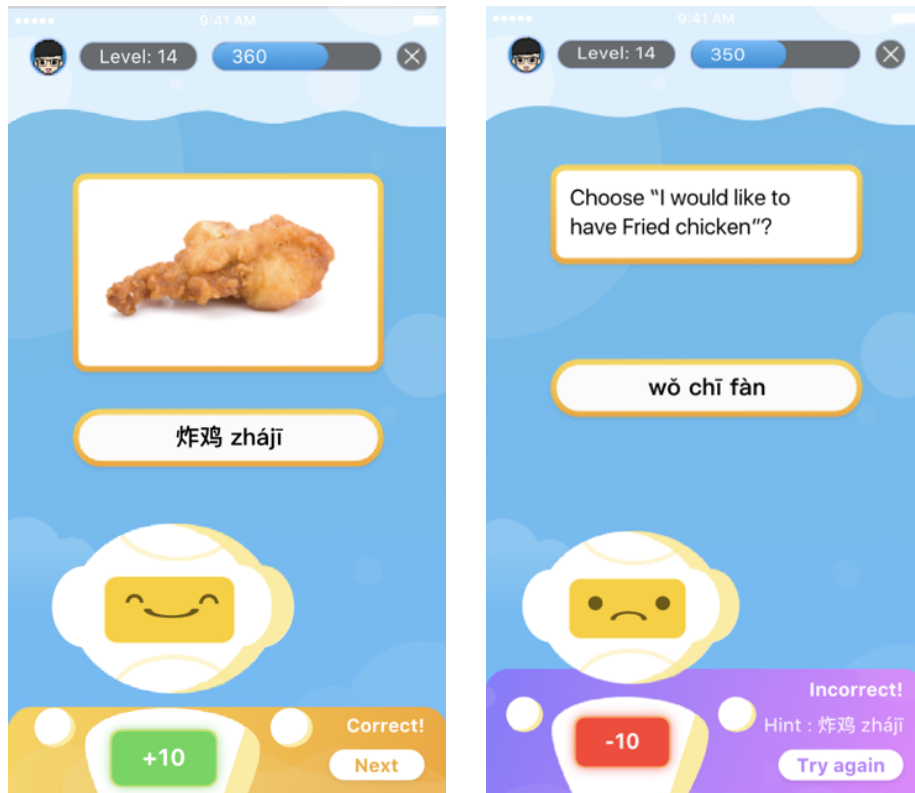


Figure 34,35. Pages for instant feedback (answer right and wrong)

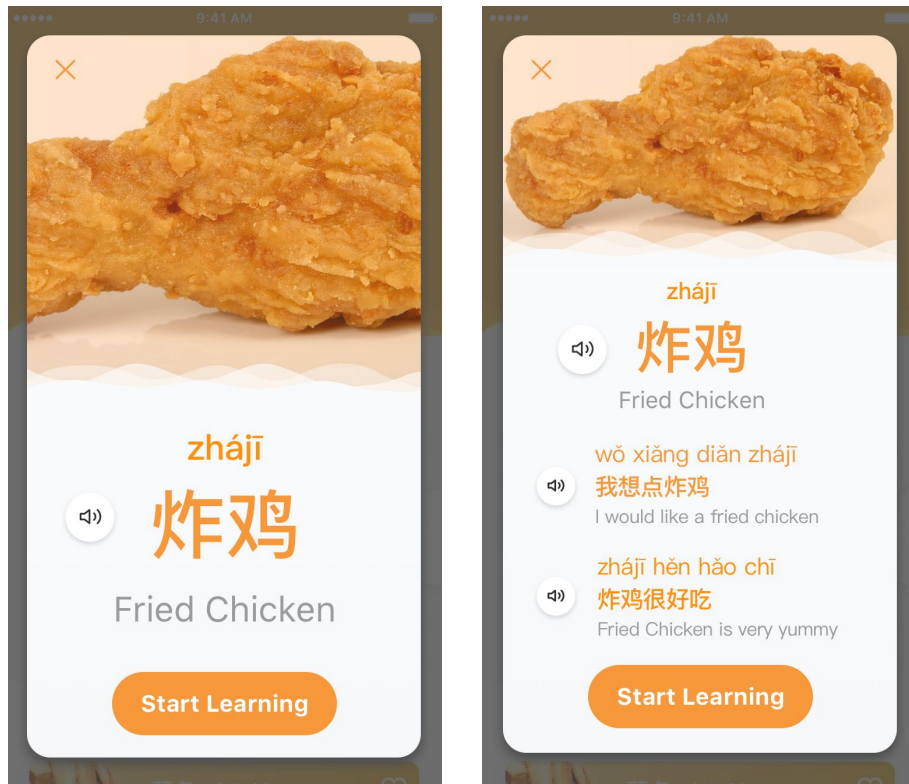


Figure 36,37. Word card page (two sides)

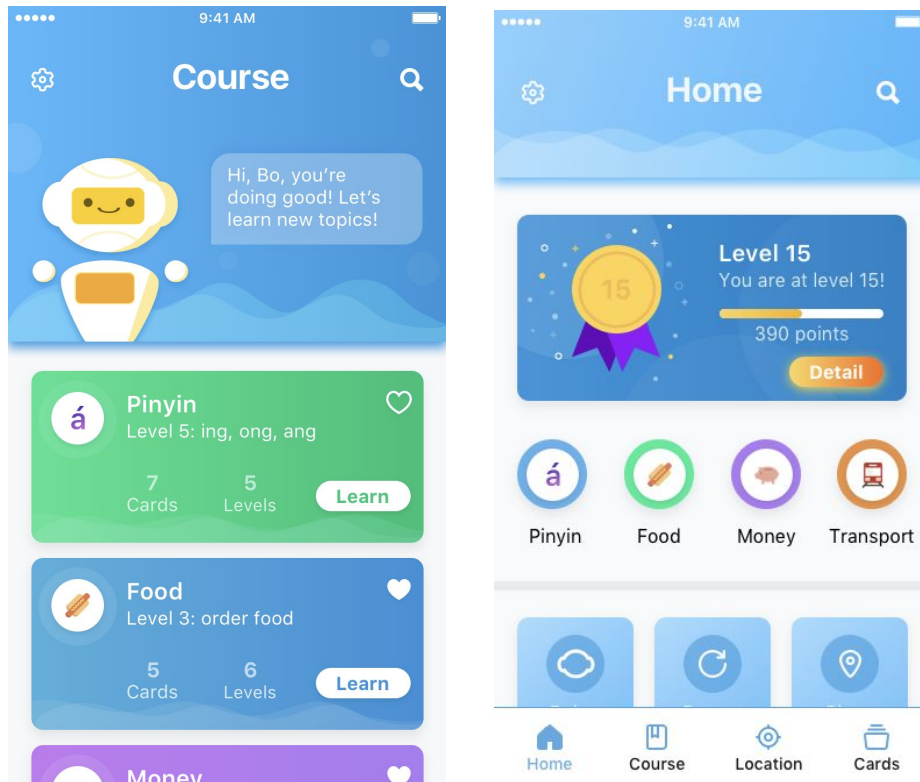


Figure 38, 39. Course page and Home page



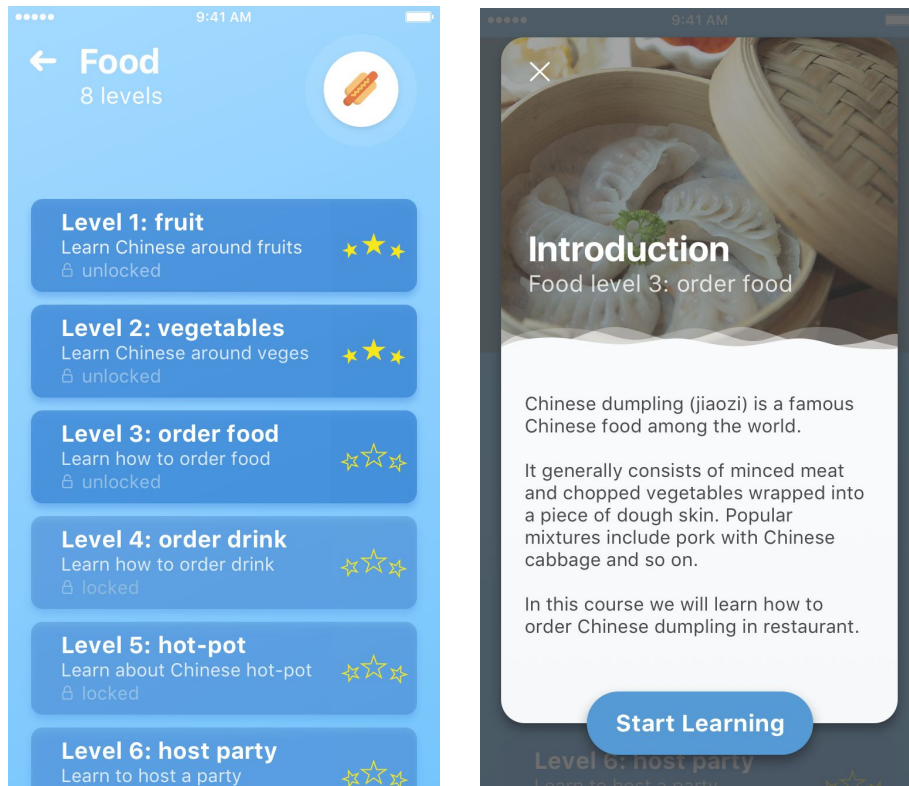


Figure 40,41. Levels and Introduction page



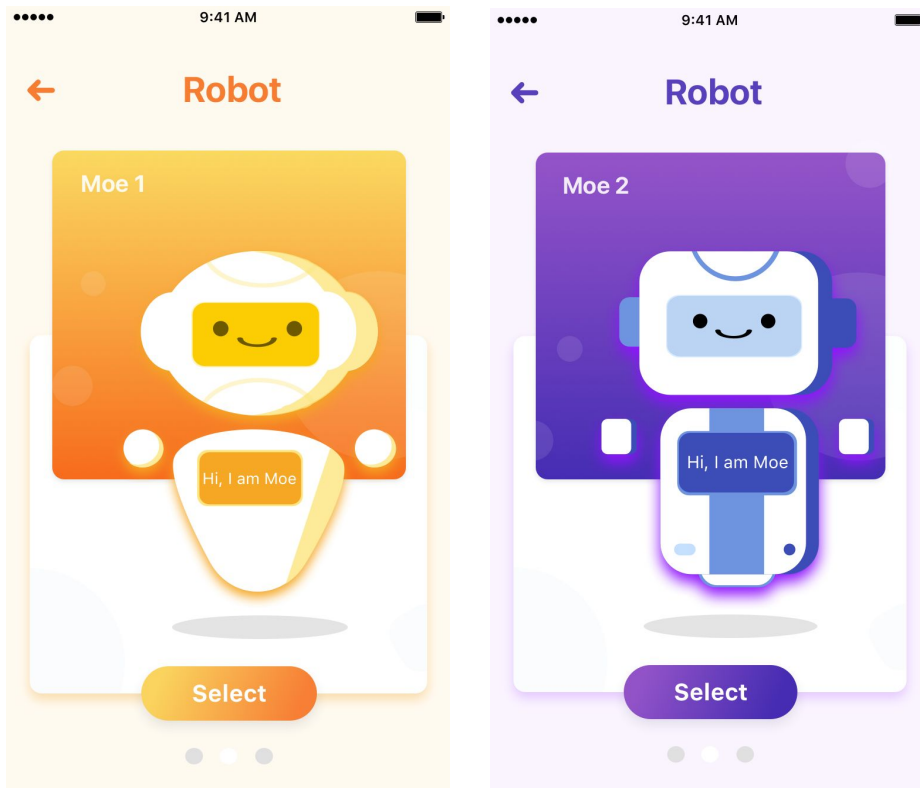
Figure 42,43. Pages for conversation study (words and dialogs)



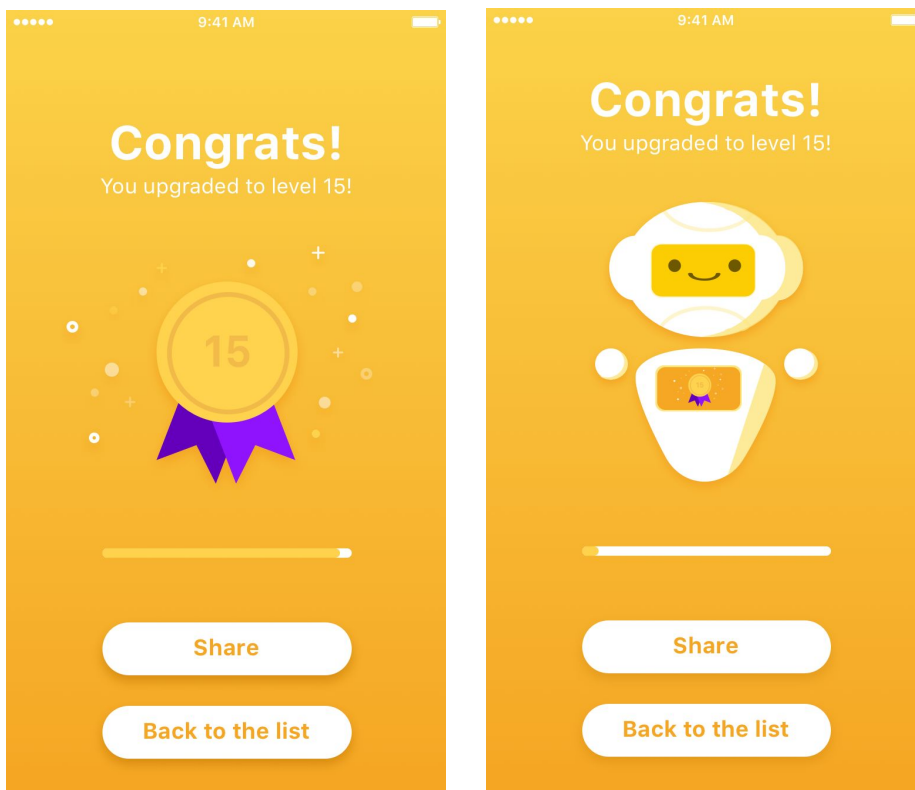
Figure 44,45. Pages for emotional feedbacks by voice (right and wrong)



Figure 46,47. Achievements and Recent page

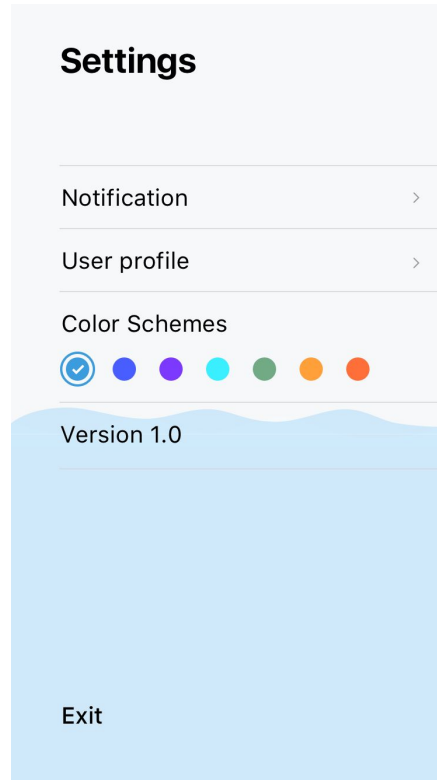
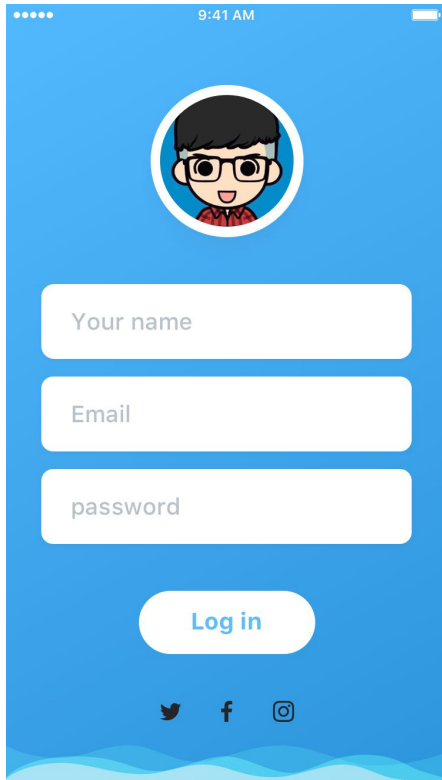


**Figure 48,49.** Robots page (two robots)

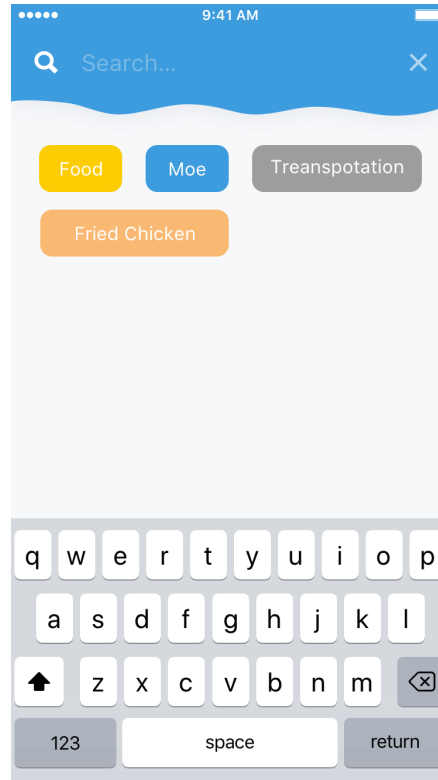
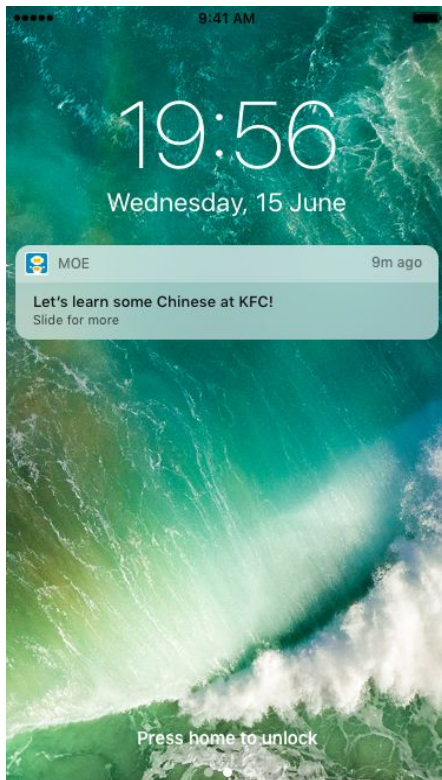


**Figure 50,51.** Pages for complete a course (level up)





**Figure 53,54.** Pages for complete a course (level up)



**Figure 55, 56.** Notification, Search page

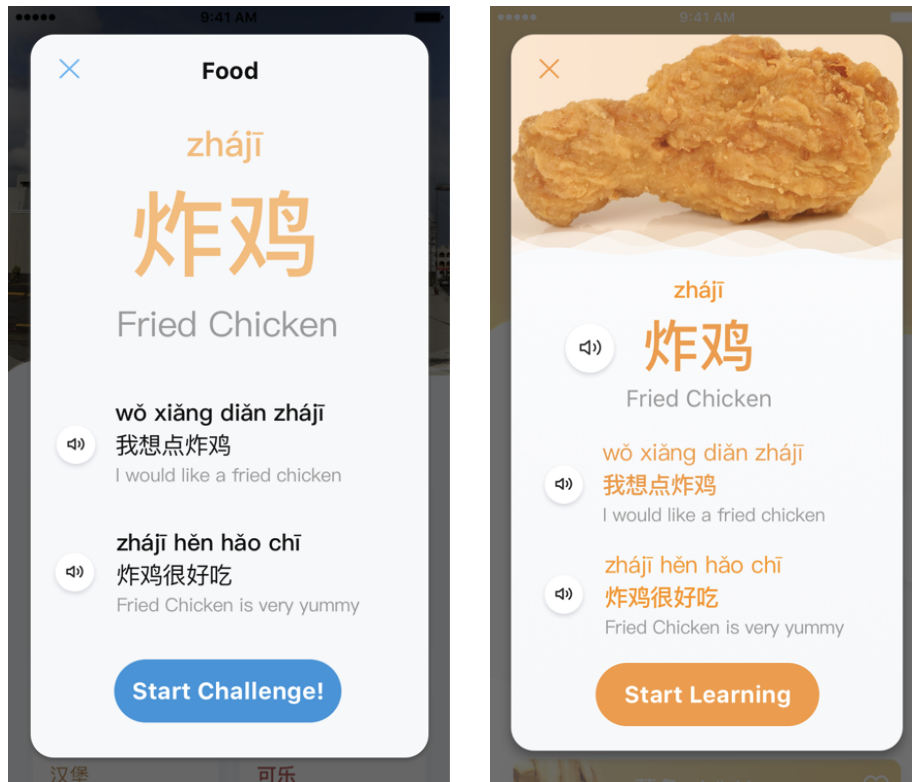
## Application Iterations - Feedback and improvement

Many attempts were made during the design process for revising the interfaces. The author learned a lot about improving visual designs (information in screens, rendering, page layout, fonts and colors) from this iterations process and enhanced the UI consistently. Figure 57 shows the The High-fidelity wireframes of the application.

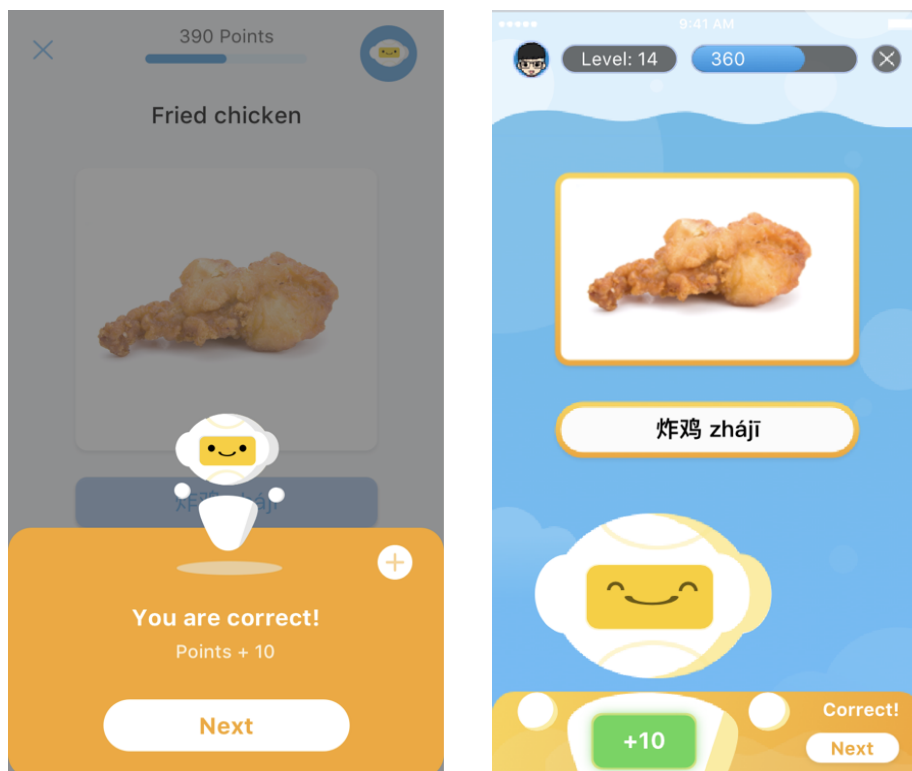
The major modifications that are made were: refine the color contrast, fonts, interface grids, and functions. Below are three examples of refined user interfaces (Figures 58 - 60). The iteration of Word card was mainly focused on color contrast. The improvement of word quiz contains making the robot bigger to show a clear facial expression as well as revised the points function in the above of the page. The interface grids were revised in the course page. Moreover, on the course page, the topic cards are refined visually for making it looks more clear and attractive.



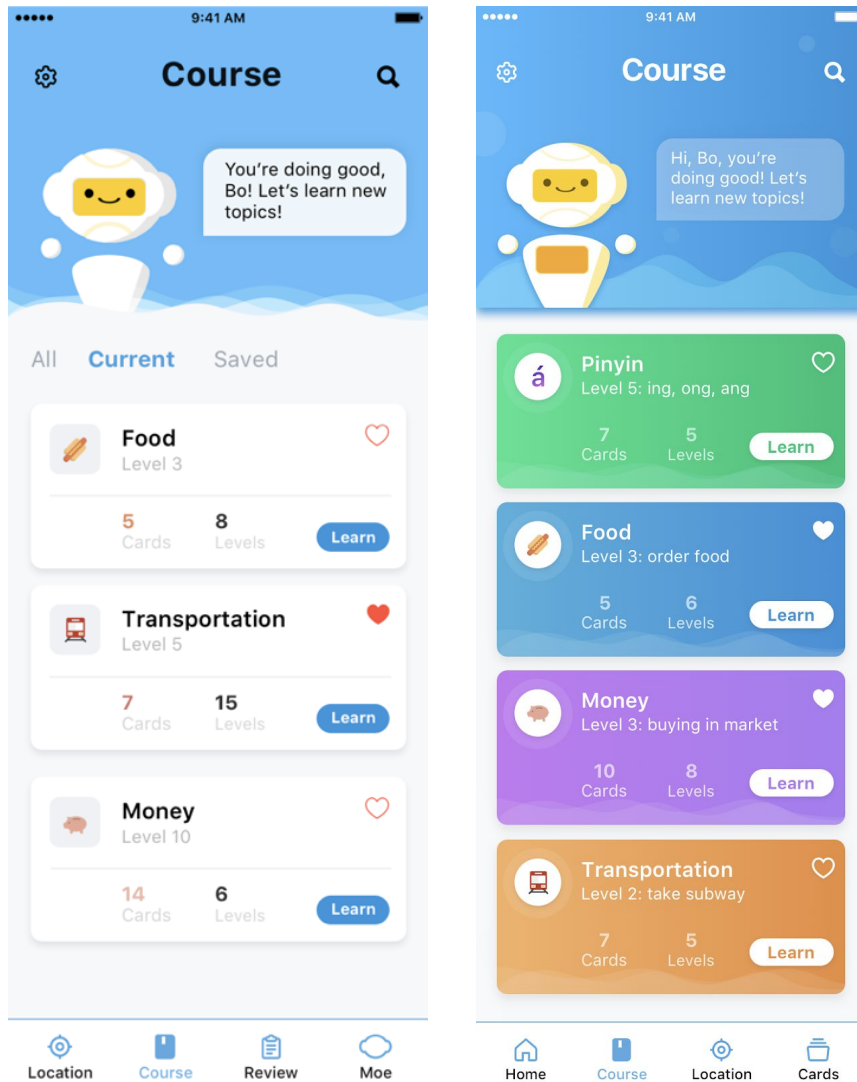
**Figure 57.** The High-fidelity wireframes of the application



**Figure 58.** The iteration of word card (the old page is on the left, and the new page is on the right)



**Figure 59.** The iteration of word quiz (the old page is on the left, and the new page is on the right)



**Figure 60.** The iteration of Course page (the old page is on the left, and the new page is on the right)

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# Results

## Usability Testing

Based on the context and use cases, usability tests were conducted. During the process, a questionnaire has been designed to conduct a usability test of the application. The questionnaire has two major components. The first is a five-point Likert Scale, (which includes user interface, user experience, etc.). The second component is a comments section as it relates to four categories: user experience, user interface, robot and educational process. Figures below (61 and 62) shows the testing process.



**Figure 61 and 62.** Usability testing in progress

Three usability testing tasks were created based on the use cases:

**Task 1** - Homepage functions (check progress and change robots and places)

**Task 2** - Location-based word learning

**Task 3** - Study of everyday words and conversation

The usability testings were conducted with target audiences including American learners and Chinese second generation of immigrant. Questionnaire feedback were provided by the participants. The overall results of the tests were positive and the participants were satisfied with the application. In regards to the perspective of UI/UX design, participants liked the design idea and visual style. They found the application is comfortable to use and easy to learn. They believe that the information in the user interfaces are well organized. Moreover, they consider the color usage was charming and attractive.

Regarding the aspect of education, participants stated that most of the study flows are working smoothly. They found that they could gain some Chinese language points efficiently by using the application. The robot in the application is adorable and welcoming in most of the cases. But the participant indicated that Moe looks not so friendly when it is performing the negative

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feedback during the learning process. In conclusion, after additional testing, this project reveals that AI technology and gamification methods could be able to support the activity of studying Chinese.

## **Results and Benefits**

The project mainly benefits language learners. By combining the AI-powered robot, a personalization approach and location based learning, this project proposes a design solution that effectively leverages the power of mobile devices and game elements to enhance language education. The design of the project was realized by comprehensive visual and interactive design studies. During the design process, several critical, visual modifications were made to increase the consistency of visual components and the usability level of the educational application. Moreover, the project explores methods of evolving language study to fit the needs of a new generation, utilizing techniques to help younger learners engage with the learning materials. Mobile technologies all easy access to media, location, entertainment, communication. This combined with a personalized and supportive AI environment represent the future in educational interactions.

As a sophisticated and playful application, HeyMoe offers a way to break into the mobile education environment. By applying the game elements to the Chinese learning activity, the participants' learning motivation and outcomes will be enhanced. For instance, the users could track their progress (how many points they have earned, what badges they have received) in the application, which they usually do in games. This project presented an example of combining the AI-powered robot as well as AI and GPS technology to enhance the power of an instructional application.

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# Conclusion

As an emerging technology, mobile interaction design is becoming increasingly popular. For example, there are mobile phone applications available for online shopping, watching videos, etc. Moreover, an increasing number of designers and researchers are conducting studies to explore the benefits of AI technology applied to various fields recently. The technological advantages of AI have tremendous potential to improve a range of educational activities. With its support, learning could become further accessible and convenient.

In this project, the application of AI in education is demonstrated. For example, learners could learn words quickly by GPS technology and AI-powered robot. Through interactions with the AI-powered robot in a personalized, educational setting, learners would feel supported and encouraged throughout the entire learning process. Gamification also implemented in the application. The homepage as dashboard could access to game elements like achievement and challenge components to increase learners' motivation and engagement in learning process.

The real value of this project could be the use of technology to create a convenient and pleasant learning environment. Students can have a fabulous study experience that will enable them to achieve their life goals through education. The research, analysis, design, and iterations of the project have given the author a deeper understanding of user interface design and how to use game elements. It has also provided valuable knowledge about second language-related instruction design and user experience design.

Concerning future iterations, HeyMoe is currently limited to the user group of college students. Designing for a different target audience, such as children, could be a valuable design direction. Additionally, the structure of HeyMoe could be applied to learning other languages. With the continuous growth of AI-based robot and mobile educational technologies, it would become more powerful and supportive of a broad range of educational activities in the future.

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# Sources for Imagery

Pictures that are free for commercial use and no attribution required from pixabay.com are used in the design of the application. They have been primarily used in the user interfaces that contains word cards and word quizzes. The pictures are also used in the places and course intro page. The sources of the images are listed below:

- Fried chicken / <https://pixabay.com/en/food-eat-diet-fried-chicken-leg-2202358/>
- Ketchup / <https://pixabay.com/en/ketchup-tomato-ketchup-portions-356438/>
- Hamburger / <https://pixabay.com/en/burger-cheese-food-hamburger-fast-827309/>
- French fries / <https://pixabay.com/en/potato-fries-fast-food-salty-3245121/>
- Coke / <https://pixabay.com/en/can-coca-coke-cola-editorial-food-87995/>
- Dumplings / <https://pixabay.com/en/dimsum-chinese-cuisine-chinese-food-2097947/>
- Mcdonald's / <https://pixabay.com/en/mcdonalds-redaktionel-chain-1340199/>
- KFC / <https://pixabay.com/en/kfc-kentucky-fried-chicken-san-juan-1574389/>



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# Appendix

## Appendix 1: User Research Questionnaire

### Gamification and language learning in mobile phones

Thank you for your participation in this study. This survey will take about 3 - 5 minutes of your time. Your participation is anonymous and voluntary. You may skip any survey questions you do not wish to answer. We appreciate your time and willingness to support this study.

**1. How old are you?**

*Mark only one oval.*

- ☐ 18 - 25  
☐ 26 - 35  
☐ 36 - 45  
☐ 45+

**2. What is your gender?**

*Mark only one oval.*

- ☐ Male  
☐ Female  
☐ Other

**3. How often do you use mobile phone apps?**

*Mark only one oval.*

- |       | 1                     | 2                     | 3                     | 4                     | 5                     |                 |
|-------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|
| Never | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Very frequently |

**4. Do you play mobile games?**

*Mark only one oval.*

- ☐ Yes  
☐ No

**5. How often do you play mobile games?**

*Mark only one oval.*

- |       | 1                     | 2                     | 3                     | 4                     | 5                     |                 |
|-------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|
| Never | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Very frequently |

**6. What types of game do you play in your mobile phone?**

*Check all that apply.*

- ☐ Card games
- ☐ Multiplayer online battle games
- ☐ Puzzle games
- ☐ Sports games
- ☐ Narrative games
- ☐ Pets-keeping games
- ☐ I don't play mobile game
- ☐ Other: \_\_\_\_\_

**7. Do you play mobile games to fill your time while you are free?**

*Mark only one oval.*

	1	2	3	4	5	
Never	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very frequently

**8. Do you use game-based mobile apps to learn a new language?**

*Mark only one oval.*

- ☐ Yes
- ☐ No

**9. How helpful do you think the game-based second-language learning apps in your study process?**

*Mark only one oval.*

	1	2	3	4	5	
Not helpful at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very helpful

**10. What problems do you have with game-based second-language learning apps?**

\_\_\_\_\_

## Appendix 2: Usability Testing Questionnaire

### Usability Testing Questionnaire

**1. The objective of the educational application was clear and easy to understand.**

*Mark only one oval.*

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly agree

**2. It was easy to use the application.**

*Mark only one oval.*

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly agree

**3. The functions of the application are well designed and easy to navigate.**

*Mark only one oval.*

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly agree

**4. I learned how to use the application quickly.**

*Mark only one oval.*

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly agree

**5. The organization of information on the user interfaces was clear.**

*Mark only one oval.*

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly agree

**6. The robot design in the application was appealing and helped with the learning experience.**

*Mark only one oval.*

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly agree

**7. The educational design of the app is effective for the learners.**

*Mark only one oval.*

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly agree

**8. I am gratified with the overall user experience of the application.**

*Mark only one oval.*

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly agree

**9. Comments (User Experience)**

\_\_\_\_\_

**10. Comments (User Interface)**

\_\_\_\_\_

**11. Comments (Robot)**

\_\_\_\_\_

**12. Comments (Educational process)**

\_\_\_\_\_